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# Mulching Improves Survival and Growth of Cercocarpus Transplants[1]

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Two-year-old plants of *Cercocarpus montanus*, (true mountainmahogany) were planted by three methods on sites prepared three ways, on a semiarid pinyon-juniper area in northern New Mexico. Two years later, plants mulched with black plastic had survived and grown better than those planted in basins. Plants in large basins survived better but were essentially the same size as plants in small basins. Best growth, by far, resulted from using plastic mulch on a chemically prepared site, and was attributed to additional soil moisture and reduced weed competition.

Keywords: *Cercocarpus montanus*, plant physiology, plant water relations.

Because it is palatable and nutritious, true cercocarpus (Cercocarpus montanus) — also known as true mountainmahogany — is a desirable shrub for revegetating western ranges. This species is relatively difficult to establish by direct seeding, however, because the seedlings are susceptible to drought and frost (Plummer et al. 1968). An alternative to seeding is transplanting. The chances of successful establishment, particularly on critical areas, are much improved by planting 1- or 2-year-old nursery-grown plants.

In New Mexico, additional moisture and control of competing vegetation improved survival and growth of fourwing saltbush (Atriplex canescens) transplants (Springfield 1970). Planting in basins and applying mulches gave the best results.

Investigators in other regions have found mulching improves the survival and growth of tree seedlings (Bowersox and Ward 1970, De Byle 1969, Loewenstein and Pitkin 1970). Of the many mulches tried, one of the most effective is black polyethylene; it conserves soil moisture and suppresses unwanted vegetation.

The purpose of the experiment reported here was to determine the effects of different methods of site preparation and planting on survival and growth of cercocarpus transplants.

## Methods

Plants used were grown for 2 years in 1-gallon containers in a lathhouse at Santa Fe, New Mexico. Seeds came from Pinabetosa Mesa, near Coyote, New Mexico. All plants were pruned to a height of 7 inches and crown diameter of 4 inches at the time of planting. Although the soil was moist, 1/2 gallon of water was applied to each plant the day of planting (August 11, 1969).

The transplants were arranged in a split-plot design. Main plots consisted of methods of site preparation: (1) none, (2) rototilled in June 1969, and (3) sprayed with dalapon in June 1969, at the rate of 10 pounds acid equivalent per acre. Dalapon is a sodium salt of dichloropropionic acid, applied in water solution to control grasses. Subplots were methods of

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planting: (1) small basin, 6 inches in diameter, 2 inches deep, (2) large basin, 18 inches in diameter, 4 inches deep, and (3) plastic mulch, 4-mil black polyethylene, 36 inches square with a slit in the middle for the transplant, and the edges held in place with soil and rocks. About 4 square feet of exposed plastic surface surrounded each transplant.

The experimental site, 8 miles west of Santa Fe, is typical of the drier portions of the pinyon-juniper woodland. Elevation is 6,400 feet; annual precipitation averages 12 inches, a third of which falls October through March. Herbaceous vegetation consists mainly of blue grama (Bouteloua gracilis), galleta (Hilaria jamesii), ring muhly (Muhlenbergia torreyi), and sand dropseed (Sporobolus cryptandrus). Soil characteristics are as follows:

| Depth (Inches) | Texture | pH |
|---|---|---|
| 0-4 | sandy loam | 7.2 noncalcareous |
| 4-11 | clay loam | 7.6 noncalcareous |
| 11-16 | silty clay loam | 8.0 calcareous |
| 16-27 | sandy clay loam | 8.0 calcareous |

Precipitation was recorded in a seasonal storage gage at the site during the study:

| | Inches |
|---|---|
| August 11 to October 17, 1969 | 4.13 |
| October 17, 1969 to May 21, 1970 | 4.56 |
| May 21 to August 14, 1970 | 4.70 |
| August 14 to October 20, 1970 | 1.50 |
| October 20, 1970 to May 4, 1971 | 2.96 |
| May 4 to August 13, 1971 | 6.20 |

The second 12 months were appreciably drier than the first 12 months after planting, especially the late summer and fall of 1970.

The height and crown diameter of each plant were measured to the nearest inch in September 1971. Size is expressed as height times diameter.

## Results

### Survival

Survival was best — 100 percent — where plants were mulched with black plastic (table 1). Survival was poorest for plants in small basins. All plants in large basins survived the first year; mortality during the second year after planting probably was due to the drier weather that year.

Although all transplants in small basins on prepared sites survived the first year, half of them died the second year on mechanically prepared (rototilled) sites. High losses such as these, particularly on prepared sites, are not easily explained. Rototilling in some way may have adversely affected the moisture-holding characteristics of the soil. Also, plants of Russianthistle (Salsola kali) and sand dropseed invaded rototilled areas and competed with the shrub transplants. Competition from the invaders was greater the second year. In contrast, very few herbaceous plants invaded the chemically treated areas. Moreover, the perennial grasses killed in place by the dalapon remained on the surface and functioned as an organic mulch, protecting the soil against moisture losses.

Table 1.--Survival and size of cercocarpus transplants 2 years after planting, by planting method and site preparation[1]

| Site preparation and planting method | Survival | | Height (H) | Crown diameter (D) | HD index |
|---|---|---|---|---|---|
| | 1st year | 2nd year | 2nd year | 2nd year | 2nd year |
| | Percent | | - - - - - - Inches - - - - - - | | |
| None | | | | | |
| Small basin | 50 | 33 | 8.0c | 4.5d | 36d |
| Large basin | 100 | 83 | 8.8c | 4.6d | 40d |
| Plastic mulch | 100 | 100 | 10.5bc | 6.7c | 70c |
| Chemical (dalapon) | | | | | |
| Small basin | 100 | 83 | 10.6bc | 5.0cd | 53cd |
| Large basin | 100 | 100 | 10.7bc | 5.8cd | 62cd |
| Plastic mulch | 100 | 100 | 16.3a | 11.0a | 179a |
| Mechanical (rototill) | | | | | |
| Small basin | 100 | 50 | 10.3bc | 4.7d | 48cd |
| Large basin | 100 | 67 | 10.8bc | 6.0cd | 65cd |
| Plastic mulch | 100 | 100 | 12.2b | 8.8b | 107b |

[1] Means within a column followed by the same letter do not differ significantly at the 5% level.

### Growth

Plants mulched with black plastic consistently grew larger than those in basins, regardless of method of site preparation (fig. 1). Plants in both the large and small basins, on the other hand, were nearly the same size.

One combination of cultural methods stands out over all the rest — using plastic mulch on a chemically prepared site (table 1). Transplants in this treatment combination grew significantly taller and wider than all others. This particular combination was almost 100 percent effective in controlling competing grasses. Rototilling, while appreciably better than no site preparation, was less effective than spraying with dalapon. On unprepared sites, grass competed with the shrub transplants even where mulched. Grass plants grew up through the slits in the plastic, and around the edges of the basins and plastic alike.

Unmulched plants that survived on unprepared sites were practically the same size in 1971 as in 1969. Increases in height and crown diameter of plants in small and large basins on prepared sites varied from slight to moderate.

### Discussion and Conclusions

The main difference between the small and the large basins was the capacity to impound water. Basins should be fairly large to provide sufficient moisture for cercocarpus transplants, under the conditions that prevailed near Santa Fe. Furthermore, the results show that — to achieve maximum survival — mulching is needed to make additional moisture available to the transplants.

Mulching with black plastic definitely improved the survival and growth of cercocarpus transplants. The main benefit from the plastic

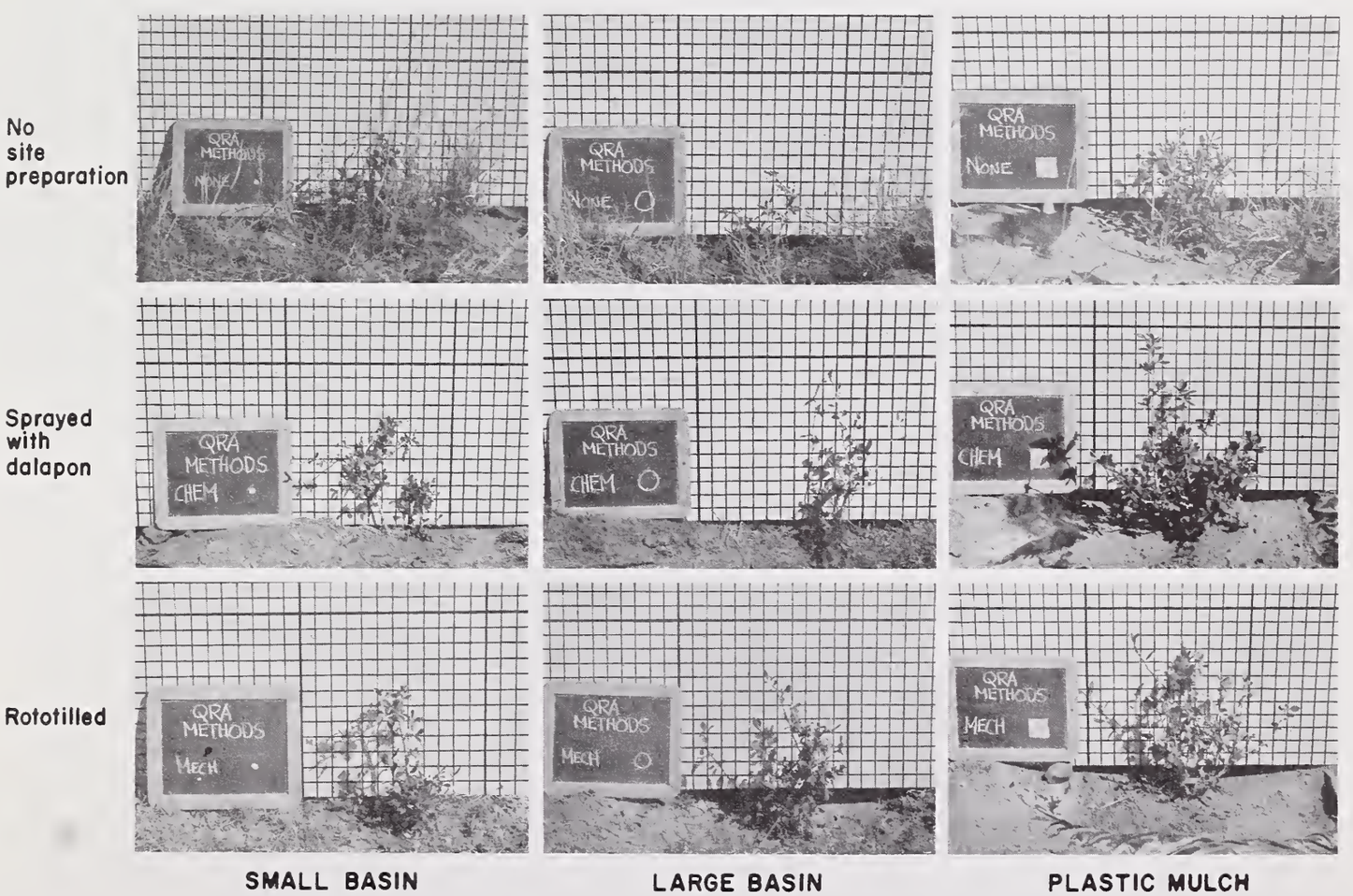


*Figure 1.--After 2 years in the field, plants mulched with black plastic showed best survival and growth.*

probably was conservation of soil moisture. For example, in Nevada (De Byle 1969), the surface foot of soil under a 3-foot-square sheet of 4-mil black polyethylene contained 4.1 percent more moisture than bare soil, which was near or at the wilting point by midsummer.

In our experiment, the plastic mulch square functioned somewhat as a miniature "trick tank." The sheet of plastic sloped down from the sides so that rain water was caught and funneled to the slit in the center. Consequently the transplant received most of the water that fell on the exposed plastic.

Another important function of the plastic was suppression of weeds. Although a few Russianthistle and sand dropseed plants became established in the center and around the edges, the plastic effectively prevented growth of most weedy species.

The plastic worked well, but any opaque material that shades out competing plants might be effective if it is at least 2 feet square and installed before soil moisture is depleted, according to results from Oregon (Hunt 1963).

The black plastic may also have affected soil temperatures. Studies have shown that soil temperatures under black polyethylene will be slightly higher and fluctuate less from day to night than under bare soil (Waggoner et al. 1960). At midday the black film itself may be as much as 14°C warmer than bare soil, but the soil is only 2° to 3°C warmer due to insulating air spaces between the film and the soil.

The cost of mulching with plastic was not determined in our experiment. Obviously, hand installation of plastic sheets around individual plants is time consuming and costly. More efficient, economical methods are available for applying plastic mulches in large-scale operations on relatively level terrain. For harsh or critical areas, however, intensive methods are required. Spot mulching coordinated with spot seeding or spot transplanting has been suggested for such sites (Springfield 1971). In Israel, spot mulching (polyethylene, 40 $cm^2$) together with spot watering (2 to 3 liters per spot at planting time) is recommended to reduce mortality and insure vigorous growth of pine seedlings (Gale and Poljakoff-Mayber 1970).

Whatever the cost, it must be balanced against the risks of failure and the costs of replanting by other methods. Other considerations are that plants not only survive better but make better growth when mulched. Therefore the plants reach a functional or usable size more quickly, whether planted for forage, soil protection, or esthetics.

Still another consideration is how long the plastic mulch will last. At several locations in New Mexico, 4-mil black polyethylene squares have remained intact 5 years. In our experience, black plastic has been more effective than straw or liquid petroleum-base mulches for suppressing weeds. No comparisons were made, but 6- or 8-mil polyethylene probably would last longer and be somewhat easier to install than 4-mil.

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